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(54) METHOD TO PRODUCE ROUGHAGE-ENHANCED GRAIN PRODUCTS

(57) The invention has as its object a method to produce roughage-enhanced grain products, particularly breads, small baked products, bakery products for long-term storage, dough products and cakes, which have a high fiber content with reduced energy content. The invention concerns the production of special flour with finely ground bran that may be used in a proportional substitution for flour, starch or sugar in normal recipes.

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Method to Produce Roughage-Enhanced Grain ProductsScope of the Invention

The invention concerns a method to produce roughage-enhanced grain products, particularly breads, small baked products, bakery products for long-term storage, dough products and cakes.

Characteristics of the Known Technical Solutions

The known methods for the production of roughage-enhanced grain products are based almost exclusively on the use of special wholemeal flours or on the proportional addition of specially treated brans (wheat, rye) to a normal baking flour. These flours are produced in wheat or rye mills during the technical portion of milling by step-wise grinding and sieving (fractioned milling) of grain, where the grinding to the intended fineness is handled by roller mills and associated screening tables.

Nafabrot is a special type of wholemeal bread, where a special wholemeal flour of milled wheat and/or rye is used. By wet milling of the grain (washing, soaking and milling the grain in excess water), the bran is removed from the kernel (DE PS 1 177 456 and 26 33 275). Milled kernels and the separated bran are then dried. The special flour is then milled from the milled grain kernels.

A flour mixture, consisting of 10% wheat flour (W 630) and 90% wheat bran is used for Weizenschalenbrot. The bran is first washed and steamed.

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A grain product with a special flour with a pretreated bran component is also known. Depending on the method of the pretreatment of the bran (mashing, chemical treatment, roasting, fine milling), various bran digestion flours are known (Klopfermehl, Friesemehl, Finklermehl; Schluetermehl). The pretreated bran is added in proportion to a standard baking flour. But this product does not have quite as high a proportion of raw fiber.

The known Malzbrot is baked from a malt flour, which is derived from milling malted barley and which is added to standard baking flours (wheat, rye) for the production of specific breads (Malfa-Kraftma-Brot) (DE PS 1 177 456; 2633 270; DE-OS 2 649 277; 2649 278; 2 159 132).

A further method to produce a product similar to wholemeal bread from rye is known, where rye bran is mixed with at least the same amount, but no more than five times as much, of binder and/or rye flour components with the addition of water and possibly leavening to a bread dough (DE OS 1 642 577).

The rye bran particles are produced during normal milling and are mixed with flours of other grains or legumes.

All known solutions have the disadvantage that their complicated production method makes the special flours technically and economically very expensive. The processes of washing, mashing, and chemical pretreatments require the use of water of drinking quality standards. The costs for water use and wastewater treatment are prohibitively high. The required drying and roasting processes for the material are very energy-intensive. The production of special flours by step-wise flour milling in all known solutions implies high machinery requirements and energy use, making them economically undesirable.

The known special flours have a different material composition compared to the special flour as described by the invention, specifically by:

- Comparably low content of raw fiber
- Content of proteins that do not contribute to the dough (albumins and globulins)
- Content of lipids
- Content of pigments.

The nutrition-physiology problem of high roughage and mineral additions to grain products and the lowering of their energy content are solved only insufficiently by the known solutions.

#### Objective of the Invention

The invention has the objective to create a method for the production of roughage-enhanced grain products in order to remove the stated disadvantages.

#### Description of the Essential Nature of the Invention

The invention is based on the objective of specifying a method for the production of roughage-enhanced grain products, where the products have a high content of raw fiber with reduced energy content, compared to normal recipes. Here the dough or material mix should have desirable properties, and the grain product should not have a coloration that differs from that of the known products.

The invention describes the production of grain products with a special flour that consists of finely ground grain bran of healthy and carefully cleaned grain.

Roughage-enhanced grain products are produced by proportionate substitution of flour, starch or sugar by a special flour in normal recipes used in known methods.

The special flour is substituted for between 0.5% and 50% of the weight. No special additives are required for dough production.

If necessary, the special flour may be treated with

suitable oxidation or reduction agents (such as hydrogen peroxide and sodium bisulfite) to lighten the color.

The augmentation of doughs and mixes with the physically-chemically essentially inert special flour generates no deterioration of their functional properties. Augmentation of grain products with the high raw fiber content of the special flour leads to an increase in the roughage content, which is significant from a nutrition physiology standpoint, and to a reduction of the energy content.

The special flour is produced by sequential treatment of the grain in the processes "Wetting", "Clean Bran" and "Mill Bran". The method is applied with known processing machinery of the grain processing industry.

The process "Wetting" adds water to the grain to produce swelling and loosening of the bran. The process "Clean Bran" partitions the bran by the force of pressure and friction. The process "Mill Bran" finely grinds the bran, with fractioning by screen sizes between 112 µm and 500 µm. To improve the hygienic condition of the special flour and to reduce germ counts, the flour may be heat-treated (steaming).

The addition of the special flour from grain as a natural raw material without chemical modification enables the use of a roughage substance consisting primarily of cellulose-rich tissue that is toxicologically harmless, easily available and cheap, but which is mostly removed with the bran during the normal processing of flour and which is therefore not made available for human nutrition.

The beneficial effects of the invention compared to the known solutions are the following:

- Essentially indifferent augmentation of grain products for the purpose of roughage enhancement by the addition to baking flour

- Addition of a special flour, which consists exclusively of the finely ground grain bran (specifically without components of the pigment and aleurone layers) without chemical or biochemical modification
- Better storage stability compared to normal flours
- No additional treatment is required to enrich foodstuffs
- Very high roughage and mineral content as well as normal coloration of the products
- Simultaneous lowering of the energy content of the grain products enriched with the special flour
- No significant adverse impact on the functional properties of doughs enriched with the special flour

#### Embodiment Examples

##### Example No. 1:

Healthy and well-cleaned grain is milled according to normal procedures. Depending on the process details, this may yield a bran partition of up to 4%. While the milled kernels are moved to normal processing, the collected bran is moved separately to fine milling. The bran is milled preferably in attrition mills, ball mills, or impact mills. By repeated screening of the milled bran on sieves with screen mesh of 112 µm, 160 µm, 250 µm, and 500 µm, a special flour with defined particle sizes is generated. The produced special flour will be used by a proportionate substitution of flour in the production of roughage-enhanced grain products, where the degree of substitution depends upon the bakery product to be produced. The addition of the special flour varies between 0.5 and 50% by weight.

Analysis

	Special Flour	Bran	Wholemeal Flour	Wheat Flour
Raw fiber, % dry matter 1)	20	4	3	0.3
Ash, % dry matter 2)	22	5	1.8	0.45
Brightness, % 3)	39		30	55

1) As defined by Scharrer-Kürschner TGL 32692/07 (Cooking with Acetic Acid ( $\text{HNO}_3$ ))

2) Incineration at 900°C and TGL

3) Reflection by means of leucometer and TGL

Wheat Bread Production with Addition of Special Floura. Dough Preparation (Valorigraph Method)

	Water Absorption, %	Dough Development, Min.	Dough [Stability] <sup>1</sup> , Min.	Dough Softening, VE
Wheat bread flour (control)	59.5	1.5	6.5	60
Wheat bread flour with 5% special flour (160 µm)	61.2	1.5	6.5	45
Wheat bread flour with 5% special flour	62.0	1.5	7.5	30

b. Fermentation Behavior (Fermentation Cylinder Method)

	Maximum Dough Volume, %	Time to Maximum, Min.
Wheat bread flour (control)	386	90
Wheat bread flour with 5% special flour	428	110

<sup>1</sup> Translator's note: Non-standard abbreviation in original, translation is speculative.

Dough recipe: Wheat bread flour      100 g  
 Yeast                          4 g  
 NaCl                          1.5 g  
 Saccharose                    2 g  
 Lard                          3 g

c. Bread Baking Experiment

	Dough Yield, %	Product Yield, %	Specific Volume, ml/g	Crumb Brightness, %
Wheat bread (control)	161	139	3.4	39
Wheat bread (enriched with 5% special flour)	165	143	3.8	27

Example No. 2 – White Bread

Recipe:      Wheat bread flour      475 g +)  
 Yeast                          30 g  
 NaCl                          7.5 g  
 Saccharose                    10 g  
 Margarine                    15 g  
 Special flour                25 g  
 Water                         250 g

+ ) 5% of flour weight substituted, particle size 250 µm

Control = 500 g

(then yeast starter consisting of 250 g flour, 30 g yeast and 100 g water)

Example No. 3 – Sandkuchen [Pound Cake]

Recipe:      Wheat bread flour      145 g +)  
 Wheat starch                145 g +)  
 Saccharose                   10 g  
 Margarine                    15 g  
 Egg                          210 g  
 Vanilla, lemon peel, baking powder  
 Special flour               25 g

17% of flour and starch component substituted, particle size 112 µm

+ ) Control: Each 170 g

Example No. 4 – Mürbteigkeks [Shortbread Cookies]

<u>Recipe:</u>	Wheat bread flour	270 g +)
	Saccharose	100 g
	Margarine	200 g
	Special flour	30 g
	Milk	about 8 g

10% of flour component substituted, particle size 160 µm

+ ) Control: 300 g

Example No. 5 – Biskuitboden [Torte Base]

<u>Recipe:</u>	Wheat bread flour	64 g +)
	Wheat starch	64 g +)
	Saccharose	125 g
	Egg (3 each)	150 g
	Baking powder, vanilla	1.5 g
	Special flour	22 g
	Water	20 g

About 15% of flour and starch component substituted, particle size 112 µm

+ ) Control: Each 75 g

Example No. 6 – Egg Noodles

<u>Recipe:</u>	Extra fine wheat flour	230 g +)
	Egg	130 g
	NaCl	1.5 g
	Special flour	20 g
	Water (to form dough)	25 g

8% of wheat flour component substituted, particle size 160 µm

+ ) Control: 250 g

Example No. 7 – Baked Goods for Long-term Storage – Käsekek [Cheese Cookie]

<u>Recipe:</u>	Wheat flour	175 g +)
	Special flour	75 g
	Margarine	75 g
	Cheese	60 g

Egg	60 g
Salt	10 g
Caraway	10 g
Paprika	5 g

About 30% of flour substituted with special flour, particle size 112 µm  
+) Control: Each 250 g